



# AMBOSELI MONITORING OUTLOOK

*In this issue: The September 2023 aerial count results.*

## Post-drought wildlife and livestock counts of Amboseli ecosystem

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### Preamble

The Amboseli Conservation Program (ACP) has conducted regular aerial counts of the Amboseli ecosystem and eastern Kajiado since 1973. The counts give a 50-year record of wildlife and livestock numbers in response to droughts and human settlement (Western and Mose 2021). ACP has commissioned the Department of Resource Surveys and Remote Sensing (DRSRS) to conduct similar counts since 2011. The two sets of counts have given very similar results over the period of overlap. ACP commissioned DRSRS to conduct an aerial count of eastern Kajiado to assess the impact of the 2022-2023 drought by comparing current figures with the pre-drought count of February 2022. DRSRS used ACP counting protocols (Jolly 1969, Western 1976) to ensure compatibility with earlier counts.

We had intended the count to be flown in April-May at the height of the long rains to ensure maximum visibility of animals against the greenery. A three-month delay in aircraft availability put the count off until August 29<sup>th</sup> to September 1<sup>st</sup>. The delay resulted in the count being conducted during a severe dry spell when the visibility of animals from the air falls relative to wet seasons. As a result we expect the counts to underestimate the numbers of smaller species in more scattered herds and animals blending into the background.

In the event the delay was fortuitous, despite the poorer counting conditions. During the long rains in April-May an east-west rainfall gradient saw pastures green up well to the west and south of Amboseli and recovery little to the east on Kuku and Rombo. The scattered rains drew large numbers of wildebeest and zebra across the border into Tanzania beyond the counting area. Had the count been conducted in May, few wildebeest would have been counted in the Amboseli ecosystem. The low numbers would have greatly exaggerated drought losses. By the end of August, a survey flight we conducted showed most but not all wildebeest and zebra to have returned to Amboseli.

## The aerial count results

The results of the aerial sample counts of wildlife and livestock flown across eastern Kajiado are given in the Table 1 below in descending order to show the relative abundance of each, and the huge preponderance of livestock relative to wildlife.

#	Species	Population Estimate	Standard Error
1	Shoats (Sheep & goats)	156,936	20,855
2	Cattle Free Ranging	84,467	11,971
3	Burchell's zebra	8,112	1,825
4	Wildebeest	5,259	2,169
5	Grant's gazelle	5,223	849
6	Elephant	2,139	652
7	Camel	1,943	1,250
8	Giraffe	1,284	301
9	Ostrich	909	219
10	Donkey	874	358
11	Impala	232	161
12	Eland	143	137
13	Warthog	125	82
14	Lesser Kudu	36	35
15	Gerenuk	18	17

Table 1: Population estimates and standard errors for all species included in the August 29th to September 2023 aerial count.

## The distribution of species

The distribution of species across the 5 X 5 kilometer grid covering the counting area is given in the maps below.

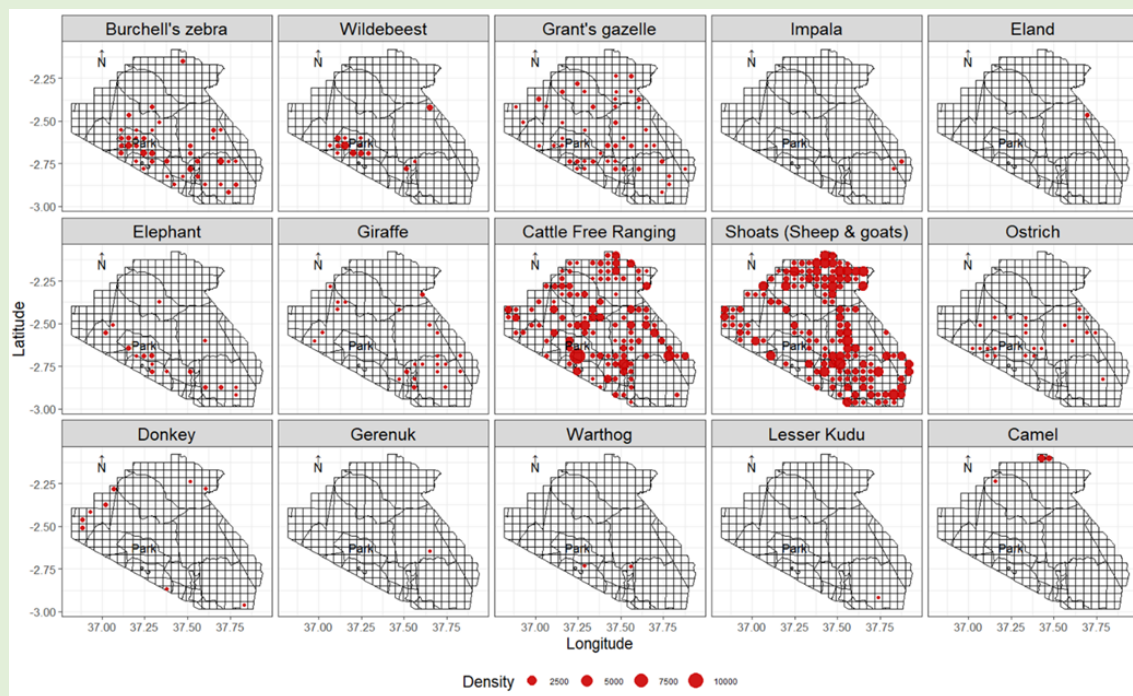


Figure 1: Distribution maps of all species counted on the DRSRS aerial survey overlaid on a 5 X 5 km grid. Group ranch boundaries are shown surrounding Amboseli National Park at the center bottom.

## Comparison with ground counts

The concentration of wildlife in and around the swamps of Amboseli National Park and the surrounding area can bias sample counts when animals are tightly clustered, leading to over or under counting. To provide a counter check David Maitumo conducted ground counts of the 700 km<sup>2</sup> area of the Amboseli Basin at the same time as the DRSRS counts. The ground counts were based on 89 random plots with a detection range not exceeding 250 meters in radius. The small plot size affords good visibility of species down to Thompson's gazelle size, and a check on the limitations of aerial counts on small species. We also intended the ground count to test the accuracy of the aerial count for the most abundance wildlife species, zebra, wildebeest and elephants. ACP will be standardizing the ground count methods by employing distance sampling analysis for wider application across the ecosystem.

Table 2 below compares the aerial and ground counts for the 700 km<sup>2</sup> Amboseli dry season concentration area.

The comparison of aerial and ground counts shows aerial counts to give good estimates of wildebeest, zebra, elephants and ostrich but to greatly underestimate smaller less common and hard to detect species.

#	Species	Ground Population Estimate	Aerial Population Estimate
1	Wildebeest	4,685	4,379
2	Burchell's zebra	4,184	4,453
3	Thomson's gazelle	1165	0
4	Elephant	559	948
5	Ostrich	326	288
6	Buffalo	285	0
7	Grant's gazelle	113	0
8	Impala	63	0
9	Reedbuck	46	0
10	Warthog	38	54
11	Giraffe	10	0
12	Hippo	4	0

*Table 2: A comparison of ground and aerial counts of the Amboseli 700 km<sup>2</sup> dry season concentration area conducted simultaneously between 29th August and 1st September 2023.*

## Impact of the 2022-2023 drought

A short preamble to the 2022-2023 drought puts the losses in perspective. Table 3 below compares counts conducted in 2010, shortly after the extreme drought of 2009 when 75 percent of cattle succumb, two thirds of the zebras, and over 90 percent of the wildebeest. The counts for 2018, 2020 and 2022 show the subsequent wildlife and livestock numbers to have recovered and peaked before the drought struck in August and September of 2022 following poor long rains. All counts were flown during the wet season, giving a good estimate of numbers for the larger and most visible species. We have included the dry season count for the 2017 in order to show dry season counts tend to considerably underestimate numbers.

Species	Population Estimates						
	Dec 2008	Feb 2010	May 2017	May 2018	Feb 2020	Feb 2022	Sep 2023
Sheep & goats	203,552	95,047	179,184	184,907	249,478	296,810	156,936
Cattle	148,021	49,368	55,874	107,358	143,601	283,849	84,467
Burchell's zebra	22,499	3,056	6,423	15,902	17,239	20,466	8,112
Wildebeest	10,772	683	4,679	8,361	8,094	8,700	5,259
Grant's gazelle	8,386	2,961	6,807	10,839	12,515	10,732	5,223
Elephant	2,016	1,137	1,361	767	1,533	2,139	2,139
Camel	18		230	1,729	981	285	1,943
Giraffe	2,645	2,682	3,202	6,667	6,828	5,562	1,284
Ostrich	1,559	1,215	882	1,266	1,052	428	909
Donkey		1,213	844	998	856	2,603	874
Impala	904	857	307	1,908	464	250	232
Eland	1,841	2,545	786	4,368	4,154	2,692	143
Warthog		259		107	303	89	125
Lesser Kudu		171	77	18	36	0	36
Gerenuk		155	38	18		18	18
Kongoni	108	463	586	196	695	89	
Thomson's gazelle	286	607	499	624	89	36	
Buffalo	54		288	428	1,355	1,711	
Oryx	361		72	464	89		
Dikdik			36				
Waterbuck	161		19				
Hippo				36			

**Table 3: Population counts from 2008 to 2023 show the extreme impact of the 2009 drought compared to the impact of the 2022 drought.**

In the case of livestock, a comparison of the pre-drought 2022 and post-drought 2023 figures suggest a very large mortality of cattle. As reported in our count of 2022, though, we showed an influx of 140,000 cattle into the Amboseli region from across southern Kenya and northern Tanzania. Comparing the 2023 figure with the pre-influx counts of 144,000 in 2020 gives a cattle decline of 40 percent. Though this figure includes increased sales during the drought, the majority is due to starvation and disease. The 40 percent decline is in line with the loss levels reported from interviews with over 300 herders (Kimiti 2023). The figures for sheep and goat declines given by comparing the post-drought 2023 figure with 2020 figure suggests a 40 percent decline similar to cattle. The decline in the case of sheep and goats was due more to sales among herders struggling to survive rather than drought mortality.

In the case of wildlife, a comparison of 2022 numbers before the drought with 2023 after the drought suggests a 60 percent loss of zebra and 40 percent loss of wildebeest. The actual losses are far lower by virtue of the 2023 count being flown during an extremely dry period and under estimating the present numbers. This is borne out by comparing the 2023 counts with the previous dry season count of 2017 (Table 3) which shows far lower numbers than in the following years.

It is also likely, based on our survey flights in late August, that sizeable numbers of wildebeest had yet to return from Tanzania, and that even larger numbers of zebra still lay outside the counting area. Carcass counts which ACP did in the Amboseli basin area during and after the drought suggest the mortality rate of wildebeest to have been on the order of 25 to 30 percent, and zebra on the order of 20-25 percent

Estimates of drought losses in other species are more problematic. The large drop in Grant's gazelle numbers in 2023 is almost certainly due to an undercount due to the dry conditions, not drought. A comparison between the 2023 dry season count with the 2017 dry season count adds weight to this view. The precipitous drop in eland numbers is likely due to herds pulling back into the Chyulu Hills and Kilimanjaro forests where they retreat in very dry seasons, not to drought losses.

The most worrying count is of giraffe. The figure of 1,200 compared to the pre-drought figures of 5,000 to 6,000 is may be partly due to poor counting conditions but certainly not to outward migration. The map of giraffe distribution (Figure 1) shows a wide distribution consistent with previous counts, but an absence in the bush country north of Amboseli where number were previously highest.

We consider the aerial counts too poor for the smaller less numerous and hard to detect species such as lesser kudu, gerenuk, warthog and kongoni to give reliable figures comparing count to count. The ostrich figures do, however, indicate the species is holding its numbers.

## Summary and outlook

The 2022-2023 drought took a heavy toll on cattle, amounting to a 40 percent or so loss. The losses, coupled with a reduction in sheep and goat numbers due herders selling animals to survive the drought, caused grave hardship among pastoralists in the Amboseli region.

A more detailed analysis of the impact of the drought can be found in the survey's conducted among herders during and after the drought <http://www.amboseliconservation.org/> .

The recent drought losses did not, however, approach the extreme livestock mortality suffered in the 2009 drought. The survey of herder responses shows families to have responded with both traditional and novel coping strategies to buffer their herds from the 2022-2023 drought. The lessons learned from these coping strategies should be widely disseminated among community members and used in both anticipating and responding to future droughts.

The impact of the 2022-2023 drought on wildlife was also far lower than the 2009 drought. Apart from the mortality figures for zebra and wildebeest being a half to a third third of the 2009 drought, the surviving numbers are far higher and auger for a more rapid recovery. Whereas only some 800 wildebeest and 3,000 zebra survived the 2009 drought, minimally over 4,000 wildebeest and 8,000 zebra survived the 2022-2023 drought. Both figures are likely considerably higher for the reasons we have given above. It is worth noting too that the wildebeest did not calve in February-March due to their poor condition. A delayed synchronized calf fall will likely boost the population later this year or early next.

Wildebeest and zebra numbers took seven to eight years to fully recover the 2009 drought, and then only because of immigration of wildebeest from adjacent populations in Tanzania and along the boundaries of Tsavo West. The 2023 surviving populations of zebra and wildebeest should see both population recover with four to five years.

The aerial counts have too high a variance to give reliable figures on elephants except when taken over many counts (Western and Mose 2023). The Amboseli Trust for Elephants has fairly reliable records of drought mortalities for 2009 and 2022-2023, indicating that despite significant losses in the recent drought, they were considerably lower than in 2009.

We have shown in a recent publication (Western and Mose 2021) that the reason for the significant increase in wildlife populations in Amboseli over the last few decades is due to the enlargement of the Amboseli swamps used as a dry season refuge by the migratory herds. The swamps, which continued to expand during the early phase of the 2022-2023 drought, was also the reason for the mortality being far lower than in the 2009 drought.

We recommend that the next ecosystem wide aerial count be conducted during April and May next year. A wet season count will give a sounder estimate of numbers surviving the drought and allow better projections to full recovery.

## References

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